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Evaluation of Canal Diameter by MRI in Sudanese Population

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Abstract

Aim of this study was to determine normal range of lumbar spinal canal in Sudanese population by using magnetic resonance imaging. This study was performed in 100 patients who underwent MRI for lumbar spine complaining from lower back pain, but all diagnosis as normal MRI findings. In this study the measurement of lumbar canal were taken at L 3 in three different cuts from MRI lumbar spine images. The mean of antrio-posterior measurement in the axial cut (1.107±0.2 cm) , mean of transverse measurement in the axial cut (1.694±0.3 cm) , mean of anterio-posterior measurement in the sagittal cut (1.397 ±0.2cm). In this study The relationship between the patient age and Anterio-posterior measurement in the axial cut was found to be a weak indirect relationship, with person correlation coefficient (- 0.111).

Keywords: Canal Diameter; MRI; Sudan.

1. Introduction

An MRI scan or CT scan These are more advanced tests that are used to visualize the nerves in the lower back and detect if they are being compressed from lumbar spinal stenosis [1]. The structure of lumbar spine is complex, to diagnose and treat this area effectively. one most have a knowledge of the normal anatomy ,following is an introduction to anatomy of lumbar spine. The tubular vertebral canal contains the spinal cord, its meninges, spinal nerve roots, and blood vessels supplying the cord, meninges, vertebrae, joints, muscles, and ligaments. Both potential and real spaces intervene between the spinal cord, meninges, and osseoligamentous canal walls.

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The canal is enclosed within its column and formed by the juxtaposition of the vertebral foramen, lined up with one another in series. The vertebral bodies and discs make up the anterior wall (with the PLL draped over it), whereas the laminae and ligamentum flavum border the canal posteriorly. Laterally, spinal nerves and vessels travel through the intervertebral foramen [2].

Other than the brain, the spinal cord is one of the 2 anatomic components of the central nervous system (CNS). It is the major reflex center and conduction pathway between the brain and the body. As noted earlier, the spinal cord normally terminates as the conus medullaris within the lumbar spinal canal at the lower margin of the L2 vertebra, although variability of the most caudal extension exists [2].

Lumbar spinal stenosis is caused by narrowing of the spinal canal or neural foramina producing root ischaemia and neurogenic claudication. Stenosis of the spinal canal is most often caused by a combination of loss of disc space, osteophytes and a hypertrophic ligamentum flavum. Not all patients with narrowing develop symptoms. Lumbar spinal stenosis, therefore, refers to a clinical syndrome of lower extremity pain caused by mechanical compression on the neural elements or their blood supply [3].

In different studies performed in several countries minimum and maximum ranges of spinal canal diameters are different for each population.

By determining normal ranges of spinal canal diameters we can make initial diagnosis in subjects who have lower diameters of spinal canal. These subjects are predisposed to spinal canal stenosis which is major cause of back pain.

2. Materials and Methods

This study was done in alzaytona specialized hospital .

MRI machine

TOSHIBA MRI (1.5 tesla) scanner, The Toshiba Excelart Vantage 1.5T MRI machine is an ultra-short, ultra-wide-bore system with adjustable lighting and ventilation features designed to ease patient anxiety without sacrificing performance. Powered by Atlas, the Toshiba Excelart Vantage 1.5T MRI system delivers high-resolution images across the entire body with faster imaging times.Each used Toshiba Excelart Vantage 1.5T MRI system features an integrated coil concept that allows for multiple examinations without repositioning the patient. Purchasing a Toshiba Excelart Vantage 1.5T MRI machine will enable comfortable exams and enhanced clinical workflow.

Patients

This study was performed on 100 patients (52 male) and (48 female), the mean age in male (45.6) years with standard deviation (12.7), in female (47.2) years with standard deviation (12.3).

Limitations of study

Study cases were selected from patients referred to perform MRI scan of lumbar spine and had lower back pain and diagnosed as normal studies. All measurements were taken at level of L3.

Examination Techniques and Image Interpretations

Examinations were made using a TOSHIBA MRI (1.5 tesla) scanner. Our study was focused on L3 level. We took a sagittal cuts of lumbar spinal canal. Then axial cuts were made perpendicular to the posterior wall of the vertebral body at L3 level

Measurements

the ligamentous interfacet distance measured between the inner surfaces of flaval ligaments on a line connecting the joint space of facet joints ,and the transverse diameter of the osseous spinal canal were measured from T2 weighted transaxial fast spin echo MR image of the lumbar spine at the level of L3. The antero-posterior diameter of the osseous spinal canal measured from T2 weighted the middle sagittal of lumbar spine.

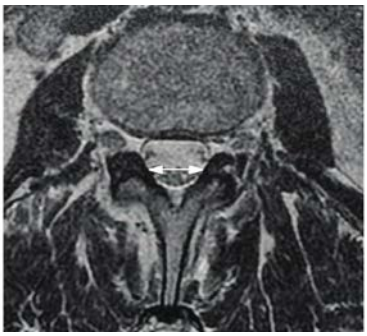

Figure 1: T2 weighted transaxial fast spin echo MR image of the lumbar spine at the level of L3.The white arrow indicates the transverse diameter of the osseous spinal canal.

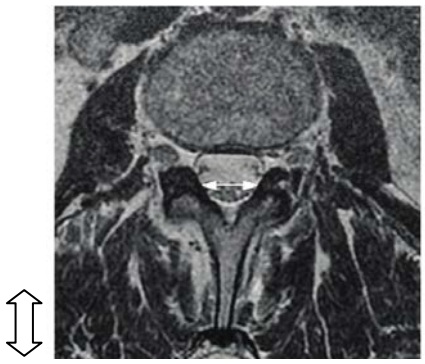

Figure 2: T2 weighted transaxial fast spin echo MR image of the lumbar spine at the level of L3. The white arrow indicates anterioposterior length of the spinal canal in millimeters from the posterior edge of the intervertebral disk edge to the most posterior point in the bony canal in the axial plane.

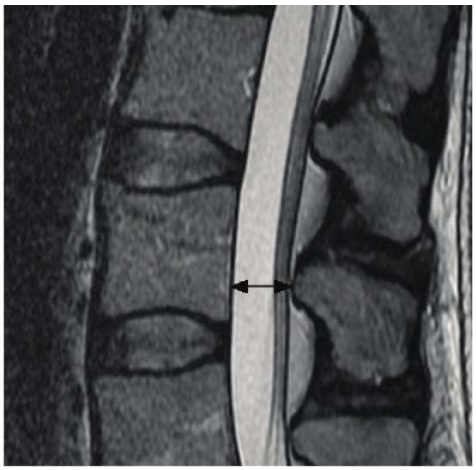

Figure 3: T2 weighted sagittal fast spin echo MR image of the middle lumbar spine. The black arrow indicates the anterio-posterior diameter of the osseous spinal canal.

3. Results

In the following pages presentation of collected data in tables and graphs

Table 1: shows frequency of gender.

Gender	Frequency	Percent
Male	52	52.0
Female	48	48.0

Age

Table 2: shows age distributions

	Age
Mean	46.39
Std. Deviation	12.503
Minimum	23
Maximum	71

Measurements

Table 3: shows study group AP and transverse in axial image and AP in sagittal image.

Cuts **Statistics**	Anterio-posterior measurement in the axial cut	Transverse measurement in the axial cut	Anterio-posterior measurement in the sagittal cut
Mean	1.107	1.694	1.397
Std. Deviation	.2001	.3038	.2363
Minimum	.6	1.0	.9
Maximum	1.6	2.5	2.0

The correlation coefficient

Table 4: shows the correlations coefficient between age and anterio-posterior measurement in axial cut

Correlations			
		Age	Anterio-posterior measurement in the axial cut
Age	Pearson Correlation	1	-.111
	Sig. (2-tailed)		.272
	N	100	100
Anterio-posterior measurement in the axial cut	Pearson Correlation	-.111	1
	Sig. (2-tailed)	.272	
	N	100	100

In this study the mean of anterio- posterior measurement in the axial cut (1.1cm) with standard deviation (0.2cm) .The mean of transverse measurement in the axial cut (1.69 cm) with standard deviation (0.3cm).The mean of anterio-posterior measurement in the sagittal cut (1.39cm) with standard deviation (0.236cm).

In this study The relationship between the patient age and Anterio-posterior measurement in the axial cut was found to be a weak indirect relationship ,with person correlation coefficient (-0.111), The relationship between

the patient age and Transverse measurement in the axial cut was found to be a weak indirect relationship ,with person correlation coefficient (- 0.030)and The relationship between the patient age and Anterio-posterior measurement in the sagittal cut was found to be a weak indirect relationship ,with person correlation coefficient (- 0.056).

Table 5: shows the correlations coefficient between age and Transverse measurement in the axial cut

Correlations			
		Age	Transverse measurement in the axial cut
Age	Pearson Correlation	1	-.030
	Sig. (2-tailed)		.769
	N	100	100
Transverse measurement in the axial cut	Pearson Correlation	-.030	1
	Sig. (2-tailed)	.769	
	N	100	100

Table 6: shows the correlations coefficient between age and Transverse measurement in the sagittal cut

Correlations			
		Age	Anterio-posterior measurement in the sagittal cut
Age	Pearson Correlation	1	-.056
	Sig. (2-tailed)		.582
	N	100	100
Anterio-posterior measurement in the sagittal cut	Pearson Correlation	-.056	1
	Sig. (2-tailed)	.582	
	N	100	100

All this measurements were said to be normal for the study group ,in comparison to other studies ,the different in population (body type) and sample size.

So these measurements could be taken as normal spinal canal diameter for Sudanese population.

4. Discussion

This study was performed on 100 patient most of patient was complaining from lower back pain.

The mean age in male (45.6) years with standard deviation (12.7) , in female (47.2) years with standard deviation (12.3).

This study shows the measurement of normal range of lumbar spinal canal .

This study shows the measurement of three different cuts from MRI lumbar spine images.

In this study the mean of anterio-posterior measurement in the axial cut (1.1cm± 0.2cm)where in Radiologic Criteria for the Diagnosis of Spinal Stenosis Results of a Delphi Survey By Nadja Mamisch , Martin Brumann and Juerg Hodler , For the Lumbar Spinal Stenosis in CT anterioposterior length of the spinal canal in millimeters from the posterior edge of the intervertebral disk edge to the most posterior point in the bony canal in the axial plane (13mm).and Transverse diameter of osseous spinal canal in MRI <15 mm .

In research [4] the result is the longest mean AP diameter was at L1 (17.5 ± 2.0 mm) in male while (18.1 ± 2.7) in female. The shortest mean AP diameter was at S1 (15.9 ± 3.2 mm) in male and (15.4 ± 3.2) in female, the AP diameter gradually decreased from L1 to S1 in female while decrease from L1 to L4 in male then slightly increase at L5 and again decrease at S1 The female mean AP diameter was larger than the male. However, the different was statistically not significant at all lumbosacral levels.

In research [5] Almost all the parameters increase from L3 to L4 to L5 but the difference is more between L4 and L5 than between L3 and L4 except in vertebral body width (VBW) where it increases smoothly, however canal body ratio remained constant at 0.6. All the parameters were larger in males than in females except antero-posterior dimension of canal in transverse section which is larger in females. It also shows that none of the parameters vary significantly depending upon sex except vertebral body width at L3 which is 39.041 ± 4.1334 in males and 36.474 ± 2.8509 in females (p=0.036).

In research [6] The antero-posterior (AP) diameter of spinal canal at L3-L4 level in male control group are between 15.25 and 16.5 mm where The AP diameter of the spinal canal at L3-L4 level in the female control group are between 14.5 and 16.22 mm.

5. Conclusion

Lumbar canal measurements are important diagnostic information for many orthopedic and neurological diseases. This study was aimed to determine the normal diameter range of lumbar canal by using MRI in Sudanese population. The diameter of spinal canal was not significantly correlated with age and gender.

6. Recommendation

This standardization measurement was made at level L3 , measurement using this reference should be made at

the same level.

Further studies should be performed in order to estimate differences among various states in sudan to establish standard data in Sudanese population.

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